CONSOLIDATED INFORMATION TECHNOLOGY SERVICES
TASK ASSIGNMENT (TA)

1. **TITLE:** (D318) Wake Vortex Avoidance Systems (WakeVAS)

TA No:	139-Rev5	
Task Area Monitor:	**Alternate Task Area Monitor:**	None
NASA POC:	**Software Control Class:**	Low Control
Type of Task:	Recurring Task	

2. BACKGROUND

NASA and the FAA have established a joint effort to develop systems for avoiding aircraft wake vortex hazards and to certify these systems for use in the National Airspace (NAS). The goal of the effort is to gain airport capacity in instrument meteorological conditions by permitting aircraft to operate closer together than current flight rules allow.

The aircraft wake vortex separation standards currently applied in the NAS are intentionally designed to be overly conservative. This design choice was necessary due to the limited knowledge that existed on the physical characteristics of wake vortex transport and decay and uncertainty concerning the hazard they represented to trailing aircraft. Thus, it has been known since the separation standards were developed that airspace capacity was being lost. In the terminal area, the current wake separation standards are often the limiting constraint on arrival and departure capacities.

Over the last 30 years, researchers have greatly expanded the knowledge base concerning aircraft wake vortex physics, wake vortex hazards to aircraft, and flight crew and controller perceptions of acceptable wake avoidance procedures. It is now almost universally agreed that wake vortex separation standards could be safely reduced, under appropriate conditions. It is, of course, an imperative that the safety of the NAS be maintained or enhanced when flight crews and/or controllers apply these new wake avoidance systems.

The wake separation standards currently employed in the NAS were developed through a process involving expert judgment, analysis of available data, operational practice, existing NAS procedures, and flight safety. They were not subjected to the formal systems development lifecycle and safety management processes now enforced by the FAA. Hence, there are essentially no guidelines or existing processes for certifying a wake avoidance system for operational use that complies with these new requirements.

The NASA/FAA effort must develop documentation supporting a favorable investment decision by the Joint Resources Council (JRC) and wake system certification plans based on program requirements provided by the FAA through its System Engineer Manual and Safety Management System, and other sources.

One aspect of National Airspace System operations that holds significant potential for operational capacity improvement is the separation criteria applied to aircraft for wake vortex

avoidance. The existing criteria, applied when operations are conducted under instrument flight rules (IFR), were conservatively designed to be otherwise independent of weather conditions. They are a function of the weight class of the generating and following aircraft (e.g., heavy, large, small). It is well understood, however, that wake behavior is also dependent on meteorological conditions as well as the physical parameters of the generating aircraft. Under many ambient weather conditions, such as moderate crosswinds or turbulence, wake hazard durations are substantially reduced. Wake vortex characteristics, in particular strength and location, must be well understood and predictable to insure that NextGen Airportal Project operational concepts such as reduced in-trail spacing or super-dense operations are developed and evaluated with representative wake vortex behavior. In supporting wake vortex research, this work directly supports the CADOM element of Airportal.

3. OBJECTIVE

The Contractor shall provide the support services necessary for the development of requirements and software to support the wake vortex elements of the NGATS Airportal project. The LaRC manager responsible for a particular project and the Contractor personnel assigned to that project shall work cooperatively and iteratively to ensure fulfillment of the mission/task objectives.

The Contractor shall provide the following (as required) :

a) Design and development of new software packages to meet specified requirements.
b) Design and development of new systems integrated from hardware, commercial software, and newly developed applications.
c) Development of software applications within existing system environments.
d) Modifications to existing software to change or add to its functionality.
e) Software support to research including the continuing evolution of algorithms and techniques.
f) Analyze data from NASA s Large Eddy Simulation computer code known as the Terminal Area Simulation System (TASS), as well as perform modifications and development to both TASS and post processing software.
g)

The following activities shall be undertaken by the Contractor in the planning and execution of the work:
a) Requirements Analysis and Planning
b) System Integration
c) Software Design and Development
d) Software Modification
e) Quality Assurance and Software Testing
f) Support for Installation, Operations, or Maintenance Services
g) Documentation
h) Problem Analysis
i) Process Improvement
j) Data Analysis

These activities shall be incrementally executed as funding and schedule permits.

4. GENERAL IT SUPPORT SERVICES

General IT Support Services Performance Metrics

Performance Standard: Assigned activities are accomplished satisfactorily and within the pre-determined schedule.

Performance Metrics:

Exceeds: All assigned activities are accomplished satisfactorily on or ahead of the pre-determined schedule. Suggestions are made and acted on that lead to advancements towards the goals of the project.

Meets: Any deficiencies or slippage in one or more activities are offset by improvements or gains in other activities.

Fails: Deficiencies or slippage in assigned activities have had a detrimental effect on the objectives of the project.

5. SYSTEM AND APPLICATION DEVELOPMENT SERVICES

Project Title: Terminal Area Simulation System (TASS) Post processing

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:Support the development and improvement of wake vortex prediction models, in support of Airportal milestones 1C02, 2C06, and 2C03. This task will analyze data from NASA s Large Eddy Simulation computer code known as the Terminal Area Simulation System (TASS), as well as perform modifications and development to both TASS and post processing software. The computations are to be performed on three of NASA s computer systems: 1) Columbia NASA s Supercomputer cluster residing at Ames, 2) Vortex , a dual processor SGI workstation residing at NASA Langley, and 3) K a mid-range SGI computer cluster at Langley that is now becoming available to Langley users. NASA supplies: 1) TASS and its existing post-processing software; 2) computer accounts on Columbia, and Langley s Vortex, and K machines.

Requirements:

The Contractor shall:

1.1) Implement both TASS and supporting software on Langley s K mid-range SGI cluster.
1.2) Develop scripts and procedures for running and debugging software on the K cluster.
1.3) Develop scripts to facilitate efficient transfer of TASS datasets that have been generated on Columbia to the K cluster.
1.4) Develop scripts to transfer data files to Langley Mass store.

1.5) Perform accuracy and timing simulations with TASS, and compare with identical cases run on Columbia.
1.6) Optimize TASS code to achieve reasonable performance.

2.1) Post process and analyze data sets from parametric TASS simulations of wake vortices conducted in ground effect.
2.2) Optimize and modify existing post-processing software to conduct this analysis.
2.3) Compare analysis with observations provided by NASA. Use analysis as guidance for modifying and improving current real-time wake prediction models.

3.1) Generate of User s Guide of latest TASS code and supporting post processing software.

Deliverables:

Number	Deliverable Item	Deliverable Schedule
1	TASS source code modified to run on the K cluster. Informal document describing software transfer process, new scripts, and a listing of codes implemented on the K cluster, timing, turnaround, and accuracy of new implementation.	As needed through 4/27/2009
2	Final documentation and excel spreadsheets containing results from parametric runs. At least one formal report detailing the analyses of the results from the parametric runs.	As needed through 4/27/2009
3	Final draft of software User s guide.	As needed through 4/27/2009

Project Title: RTD Numeric modeling support

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:Work area is a unified minicomputer cluster running Fedora Linux, and Portland Group Compilers. The applications are MM5 WRF-ARW, and WRF-NMM. This computer model supports the WakeVas effort and RTD's Wake Vortex studies, and more broadly, NASA's Aircraft Safety mission. NASA shall provide access to computer hardware and software required to run the models

Requirements:
The Contractor shall:
(1) provide SA support for the cluster, and
(2) provide data collection for the model simulation, rudimentary checks of the model output,
(3) archive of input and output data, and
(4) interface with NASA specialists to improve the accuracy and performance of the model.

6. WORK-AREA SPECIFIC SERVICES

None required.

7. Exhibit A

None required.

8. SPECIAL SECURITY REQUIREMENTS

None required.

9. SOFTWARE ENGINEERING PROCESS REQUIREMENTS

The Contractor shall follow the ConITS SA/SPMP as tailored for this application.

10. JOINT REVIEW SCHEDULE

Reviews will be held as required.

11. PERIOD OF PERFORMANCE

This TA is effective from 08/01/05 to 04/27/10

12. TECHNICAL PERFORMANCE RATING

In evaluating Technical Performance, quality and timeliness shall be rated as follows:

Quality: 50% Timeliness: 50%

13. RESPONSE REQUIREMENTS

This Task Plan shall address the contractor's specific work plans, associated estimated labor hours, cost and schedule.

14. GOVERNMENT ESTIMATED COST

15. FUNDING INFORMATION

16. MILESTONES

None required.

17. DELIVERABLES

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1	TASS source code modified to run on the K cluster. Informal document describing software transfer process, new scripts, and a listing of codes implemented on the K cluster, timing, turnaround, and accuracy of new implementation.	As needed through 4/27/2010
2	Final documentation and excel spreadsheets containing results from parametric runs. At least one formal report detailing the analyses of the results from the parametric runs.	As needed through 4/27/2010
3	Final draft of software User s guide.	As needed through 4/27/2010

18. FILE ATTACHMENTS

None.